Remarks

Entry of the amendments presented, reconsideration of the application and allowance of all pending claims are respectfully requested. Claims 1, 2, 9-11, 16, 17, 24-26, 31, 32 & 39-41 remain pending.

The final Office Action initially stated that the title of the application is too broad and should be changed to provide a complete and detailed description of the invention. In response, applicant has amended the title herein.

Relative to the restriction requirement, the final Office Action stated that applicant's arguments were not persuasive and that the restriction was maintained. In response, applicant herein cancels claims 3-8, 12-15, 18-23, 27-30, 33-38 & 42-45 without prejudice.

By this amendment, independent claims 1, 16 & 31 are amended to further characterize the reduction of data movement in the server. Support for these amendments can be found throughout applicant's specification, and in particular at page 8, lines 15-22; page 9, line 3; page 12, line 26 – page 13, line 7 and page 21, lines 1-5. No new matter is believed added to the application by any amendment presented.

In the final Office Action, claims 1, 16 & 31 were initially rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. More specifically, the Office Action stated that the recited phrase "irrespective of the server having knowledge of the request prior to receipt thereof" (e.g., claim 1) is not enabled in the specification, and characterized the phrase as a negative limitation simply to avoid pertinent art.

Without acquiescing to the Office Action's characterization of the above-referenced phrase including "irrespective" as a negative limitation, applicant respectfully submits that it is the current view of the courts that there is nothing inherently ambiguous or uncertain about

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a negative limitation. See *In re Wakefield*, 422 F.2d 897, 899, 904, 164 USPQ 636, 638, 641 (CCPA 1970); *In re Barr*, 444 F.2d 588, 170 USPQ 330 (CCPA 1971); MPEP 2173.05(i). Further, any negative limitation must have basis in the original disclosure. See *Ex parte Grasselli*, 231 USPQ 393 (Bd. App. 1983), *aff'd mem.*, 738 F.2d 453 (Fed. Cir. 1984). Even if the above-referenced phrase is a negative limitation, applicant respectfully submits that it has adequate basis in the application as filed. Applicant's specification explicitly states that "no advance notice or prediction on the access pattern of data in the files is necessary" (specification, page 38, lines 9-11). The access pattern of data in files refers to the data (or order of data) accessed by, for example, a read or write request to be processed by a server. The server, therefore, does not require advance notice of what data files will be accessed by a request or in what order that access will occur (i.e., the server does not require knowledge of a read or write request prior to receipt of that request).

This lack of a requirement for prior knowledge of a request is further supported in FIGs. 3A-3D, which depict request processing, and FIGs. 9A-9B & 10A-10B, which depict additional details of a read operation and a write operation, respectively. These figures indicate when the server obtains information from the current request to determine segment numbers that identify the files and order of files (or portions of files) that are being read or written to (see 904, FIG. 9A; 916, FIG. 9B; 1002, 1012, FIG. 10A; see also specification, page 26, lines 14-17; page 27, lines 4-6; page 30, lines 15-16; and page 31, lines 5-6). There is no analogous segment calculation step (or any other step) wherein the identity or order of files (or portions of files) is determined for a next request (see, e.g., FIGs. 3A-3D, generally).

Regarding the statement in the Office Action that the above-referenced phrase is a negative limitation simply to avoid prior art, applicant respectfully submits that avoidance of prior art is an appropriate reason for an amendment, whether or not it includes a negative limitation. In this case, the reason for including the phrase is further bolstered by the above-described support found in the specification.

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In light of these amendments and the statements above, applicant respectfully submits that the above-referenced phrase describes subject matter that fulfills the written description requirement. Thus, applicant requests that the rejection based on 35 U.S.C. 112, first paragraph, he withdrawn.

Substantively, claims 1, 16 & 31 were also rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art in the background in view of Burnett et al. (U.S. Patent No. 6,006,018; hereinafter, "Burnett") and Cox et al. (U.S. Patent No. 5,539,757; hereinafter, "Cox"); and claims 1, 2, 9-11, 16, 17, 24-26, 31, 32 & 39-41 were rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art in the background in view of Ledain et al. (U.S. Patent No. 6,021,408; hereinafter, "Ledain") and Hamilton et al. (U.S. Patent No. 5,799,150; hereinafter, "Hamilton"). Applicant respectfully, but most strenuously, traverses these rejections to any extent deemed applicable to the independent claims presented herewith.

An "obviousness" determination requires an evaluation of whether the prior art taken as a whole would suggest the claimed invention taken as a whole to one of ordinary skill in the art. In evaluating claimed subject matter as a whole, the Federal Circuit has expressly mandated that functional claim language be considered in evaluating a claim relative to the prior art. Applicants respectfully submit that the application of these standards to the independent claims presented herewith leads to the conclusion that the recited subject matter would not have been obvious to one of ordinary skill in the art based on the applied patents.

Applicant recites a technique for reducing data movement within a computing environment (e.g., claim 1, as amended herein). The technique includes transmitting data between a file system of a server of the computing environment and a transmission medium of the computing environment, the transmitting being responsive to a request for transmission received by the server. The server includes at least one file system buffer and at least one non-file system buffer. The data transmission further includes transmitting data directly between the transmission medium and one or more buffers of the at least one file system buffer, thereby reducing data movement in the server by bypassing copying the data

between one or more buffers of the at least one non-file system buffers and the one or more buffers of the at least one file system buffer in performing the transmission. This copying of the data is bypassed irrespective of the server having knowledge of the request prior to the request's receipt.

Applicant's invention thus recites, in part, reducing data movement in the server by bypassing the copying of data between non-file system buffers and file system buffers of the server. Applicant respectfully submits that at least this feature of the claimed invention is not taught, suggested or implied by applicant's admitted prior art, Burnett or Cox, alone or in combination.

Applicant's Background Art describes a Distributed File Services (DFS) system, in which data is moved from one set of buffers within the server to another set of buffers within the server. These data movements increase processing time at the server, thereby negatively affecting response time of requests (e.g., read and write requests) (see applicant's specification at page 2, lines 12-19). Applicant respectfully submits that the Background Art does not teach or suggest a technique for bypassing the copying of data between non-file system buffers and file system buffers, for reducing data movement in a server by bypassing such copying, or for bypassing such copying irrespective of the server having advance knowledge of a request to transmit data received by the server, as presently claimed. At least some of these features lacking in the Background Art are also not taught, suggested or implied in Burnett or Cox.

Burnett discloses a distributed file system translator technique that provides authenticated access to files stored in a target distributed file system in response to requests from clients in a source distributed file system. The technique includes mapping credentials associated with the requests into enhanced credentials that include authentication information (see Abstract). In Burnett, a remote access of a file occurs through a two-step caching process whereby a server node retrieves the file and stores it in a server cache, and a client node goes out over the network, retrieves the file, and stores it in a client cache (see FIG. 1; Col. 4, lines 44-66). This is very different from the data transmission recited in the claims

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presented herewith, in which transmitting data directly between the transmission medium and file system buffers reduces data movement in the server by bypassing the copying of data between non-file system buffers and file system buffers. The Office Action acknowledged that Burnett does not teach bypassing non-file system buffers. Applicants respectfully submit that the more specific recitation in the claims presented herewith (i.e., bypassing copying data between non-file system buffers and file system buffers) is also not taught, or even suggested, by Burnett.

Cox does not overcome the deficiencies of Burnett as applied to the present invention. Cox describes an error correction technique that uses convolutional encoding (i.e., an encoding scheme that introduces patterns of redundancy into data to improve the reliability of transmission). The scheme modifies a standard decoder associated with convolutional encoding (i.e., a Viterbi decoder) to decode the encoded data after the data passes through a channel (see Abstract; Col. 1, lines 14-18). Selected metrics (i.e., likelihood functions) are calculated to determine the correct decoded sequence (see Col. 5, lines 27-28; Col 12, lines 40-54). Decoding in Cox is done in stages during which metric computations are updated and stored in buffers (see Col. 12, lines 55-61). This is very different from applicant's recited features associated with buffers. As stated above, in the present invention, the direct transmission of data between the transmission medium and file system buffers reduces data movement by bypassing copying the data between non-file system buffers and file system buffers. This reduction of data movement by bypassing the copying of data to facilitate data transmission is not taught or suggested in Cox. Instead, the Cox patent describes avoidance of data movement associated with an exchange of pointers to buffers to facilitate metric computations (Col. 12, lines 55-65). Further, Cox addresses buffers, but does not teach or suggest bypassing copying of data between certain types of buffers, namely between non-file system buffers and file system buffers, as recited in the claims presented herewith.

Based on the foregoing, it is believed that applicant's admitted prior art, Burnett and Cox fail to teach, suggest or imply at least applicant's recited feature of bypassing copying the data between one or more buffers of the at least one non-file system buffer and the one or more buffers of the at least one file system buffer. Thus, applicant respectfully submits that

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the combination of applicant's admitted prior art, Burnett and Cox also fails to teach, suggest or imply at least the above-referenced feature.

Relative to the second obviousness rejection described above, applicant respectfully submits that at least some of the above-noted features of the present invention are not taught, suggested or implied by applicant's admitted prior art, Hamilton or Ledain, alone or in combination.

As noted above, applicant's Background Art describes a DFS system that includes data movement from one set of server buffers to another set of server buffers. At paragraph 9 on page 4 of the Office Action, it is stated that applicant's Background Art does not teach bypassing non-file system buffers. Again, applicant respectfully submits that the Background Art also does not teach or suggest a technique for bypassing the copying of data between non-file system buffers and file system buffers, for reducing data movement in a server by bypassing such copying, or for bypassing such copying irrespective of the server having advance knowledge of a request to transmit data received by the server, as presently claimed. These features that are absent in the Background Art are also not taught, suggested or implied in Hamilton or Ledain.

Hamilton describes a distributed multimedia system which enables real-time transmission of broadcast quality media data over a network (col. 3, lines 38-40 thereof). Prior to a server receiving a client's request to read media data, the Hamilton technique creates and populates a TrackList data structure residing on the server to store the media data that the client will need (col. 6, lines 32-36; col. 7, lines 6-10). The TrackList also allows the server to perform read ahead operations to satisfy subsequent read requests (col. 7, lines 21-28). Processing these read requests results in, for example, audio/video playback wherein data is transmitted directly to "userlevel" memory buffers of the client (col. 6, lines 5-7; col. 10, lines 3-6). This is very different from applicant's invention, which recites, in part, data transmission that bypasses copying data between non-file system buffers and file system buffers of a server, irrespective of the server having prior knowledge of the request for data transmission. Hamilton's playback data transmission results from the server using the

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predictive information of the TrackList to perform read aheads to satisfy current and subsequent client read requests (col. 7, lines 19-28). Thus, Hamilton relies on the server having advance knowledge of a client's read request. For the reasons stated above, applicant respectfully submits that Hamilton does not teach, suggest or imply bypassing copying data between buffers irrespective of the server having prior knowledge the data transmission request.

Further, as stated above, Hamilton fails to teach, suggest or imply bypassing copying data between non-file system buffers of a server and file system buffers of a server. When the Hamilton technique directly transmits media data to a userlevel memory buffer, it bypasses copying media data to system memory buffers (col. 6, lines 3-7; col. 9, lines 57-67). However, this buffer bypass is quite different from the bypassing of buffers recited in the present invention. In Hamilton, the bypassed system memory buffers reside on the client side (col. 6, lines 6-7). In contrast, the bypassed non-file system buffers of applicant's claimed invention reside on the server (see, e.g., claim 1). Moreover, since the buffer bypassing in Hamilton occurs at the client, the resulting data movement reduction is also limited to the client side (Abstract; col. 6, lines 3-7). Applicant's invention, on the other hand, recites reducing data movement in the server.

In the Office Action, col. 9, lines 59-67 and col. 10, lines 34-39 are cited as teaching bypassing system buffers. The referenced sections describe bypassing system memory buffers, but the related discussion indicates that these buffers are bypassed in the client rather than the server (see also col. 10, lines 3-6 and FIG. 7 of Hamilton). In its Response to Amendment, the Office Action stated that "a client regularly acts as a server and/or both depending on the client's function at a particular point in time" (page 6, paragraph 15). Applicant submits that such dual functioning is possible, but the description in Hamilton limits the functionality of the client to sending client-based requests for services provided by the server (e.g., a request for an audiovisual file). Thus, this section of Hamilton does not teach or suggest reducing data movement on a server by bypassing the copying of data between non-file system buffers and file system buffers of the server, as recited by the claims presented herewith.

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To summarize, Hamilton does not teach, suggest or imply bypassing copying data between non-file system buffers and file system buffers of a server, nor bypassing such copying to reduce data movement within a server, nor bypassing such copying irrespective of a server having advance knowledge of a data transmission request,. Thus, since Hamilton fails to describe or suggest multiple aspects of applicant's invention as claimed herein, Hamilton does not render applicant's invention obvious, alone or in combination with the other applied art.

Ledain describes a log-structured file system including a disk with the main file system and multiple log disks. File write operations store file and system data to the log disks rather than to the main file system. A control program in Ledain manages the migration of the previously written data from the log disks to the main file system (see Abstract and col. 5, lines 36-61 thereof). Thus, Ledain's technique improves file writing speed at the expense of extra disk space. Applicant respectfully submits that Ledain's subject matter is quite different from the present invention's. For example, the technique of Ledain is directed to avoiding writing to a file system disk, while the applicant's invention avoids data movement in a server. More particularly, Ledain addresses log devices in a file system without any need for a server receiving requests (see, e.g., FIGs. 1-3). Since Ledain's file system is silent as to a server receiving data transmission requests, it follows that Ledain is also silent as to teaching, or even suggesting, that a server's prior knowledge of such a request (or lack thereof) is relevant to any action, let alone the bypassing of copying data between non-file system buffers and file system buffers. Thus, applicant respectfully submits that Ledain does not teach or suggest buffers being bypassed irrespective of a server having advance knowledge of a data transmission request, as claimed by the present invention. Further, Ledain does not describe or suggest bypassing non-file system buffers of a server, nor bypassing such buffers for the purpose of reducing data movement in the server.

The Office Action cites col. 3, lines 18-19 of Ledain as teaching buffer bypassing in a file system. Applicant notes that this section of Ledain is only a statement of the conventional practice of writing files directly to disk cache rather than to memory cache, and is therefore not a teaching, per se, of buffer bypassing. Further, applicant respectfully

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submits that the cited bypassed memory cache is a file system buffer. Thus, this section of Ledain does not describe or suggest bypassing copying data between a non-file system buffer and a file system buffer, as claimed by the present invention. The Office Action also cites col. 12, lines 38-44 as teaching buffer bypassing in a file system. This section of Ledain describes that a function call may specify options to bypass processing data by the log device. Applicant respectfully submits that this bypassing is concerned with function calling and thus, is not directed to buffers, nor to bypassing non-file system buffers to reduce data movement in a server, as claimed by the present invention. The Office Action's reference to col. 2, lines 12-13 of Ledain is only a statement that some file system network protocols require that file data be written immediately to disk rather than to memory. Applicant respectfully submits that this section of Ledain does not describe or suggest reduction of data movement by bypassing the copying of data between non-file system buffers and file system buffers, as recited by applicant.

Since applicant's stated prior art, and the Hamilton and Ledain patents each fail to teach or suggest multiple features of applicant's claimed invention, the combination thereof also fails to teach or suggest multiple aspects of applicant's claimed invention.

For the above reasons, applicant respectfully submits that independent claims 1, 16 & 31 recite patentable subject matter. The dependent claims at issue are believed patentable for the same reasons as the independent claims from which they directly or ultimately depend, as well as for their own additional features.

For example, claim 10, which depends from claim 9, recites that the transmitting includes sending data from the file system over the transmission medium to a receiver of the data. This claim further recites that the sending includes using a routine identified by the receiver to send the data, wherein the routine is provided one or more pointers to the data to be sent to the receiver. Thus, applicant's invention passes function pointers so that data may be transmitted directly from file system buffers while bypassing non-file system buffers. Applicant respectfully submits that a careful reading of Hamilton, including the portions referenced in the Office Action relative to claim 10 (i.e., col. 8, lines 39-43 and col. 7, lines
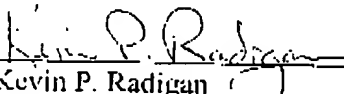
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51-52), reveals no description or suggestion of passing pointers to send data for the purpose of bypassing the copying of data between non-file system buffers and file system buffers. Thus, for the reasons stated above, applicant respectfully submits that the dependent claims presented herewith patentably distinguish over the applied art.

All claims are believed to be in condition for allowance and such action is respectfully requested.

Should the Examiner wish to discuss this case with applicants' attorney, the Examiner is invited to contact applicants' representative at the below-listed number.

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